APPENDIX C

DETAILS OF THE STRATEGIC MODERNIZATION PROGRAM ASSUMED IN THE ANALYSIS

TABLE C-1. LAND-BASED MISSILE FORCE UNDER THE ADMINISTRATION'S MODERNIZATION PROGRAM (By fiscal year)

	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
MM II	450	450	450	450	450	450	450	450	450	450	450	450	450	450
MM III (Mk12)	250	248	223	204	200	200	200	200	200	200	200	200	200	200
MM III (Mk12A)	300	300	300	300	300	300	300	300	300	300	300	300	300	300
MX Silo-based	27	46	50	50	50	50	50	50	50	50	50	50	50	50
SICBM	---	---	---	---	---	7	36	84	168	276	384	492	500	500
MX Rail-based	---	---	---	---	---	18	42	50	50	50	50	50	50	50

SOURCE: Congressional Budget Office projections based on Fiscal Year 1988 Report of Secretary of Defense Caspar W. Weinberger; Fiscal Year 1988 Congressional Data Sheets; DoD Selected Acquisition Reports.

NOTE: Modernization program not constrained by arms-control limits.

TABLE C-2. STRATEGIC BOMBER FORCE STRUCTURE UNDER THE ADMINISTRATION'S MODERNIZATION PROGRAM (By fiscal year)

	1987	1988	1989	1990	1991	1992	1993
B-52G							
Penetrate a/	61	61	0 b/	0	0	0	0
Standoff-Penetrate c/	89	89	0	0	0	0	0
Standoff d/	0	0	90	70	50	20	0
B-52H							
Penetrate	45	21	0	0	0	0	0
Standoff-Penetrate	45	69	79	58	39	20	0
Standoff	---	---	11	32	51	70	90
B-1B							
Penetrate	58	90	90	90	90	75	45
Standoff-Penetrate	---	---	---	---	---	15	45
ATB	---	---	---	---	2	14	46
ALCM/ACM e/	1,530	1,584	1,746	2,124	2,502	2,880	2,880
SRAM	1,100	1,100	1,100	1,100	1,100	1,100	1,035
SRAM II	---	---	---	---	---	---	90

SOURCE: Congressional Budget Office projections based on phasing of roles and missions described in Fiscal Year 1988 Report of Secretary of Defense Caspar W. Weinberger, February 1987 Fact Sheet provided by the Air Force, and budget information from the Department of Defense.

NOTES: All values are in terms of primary authorized aircraft (PAA), an Air Force measure that takes account of the roughly constant 10 percent of total aircraft in the maintenance pipeline and thus not available for use. Unless otherwise noted, bombers are assumed to use penetration tactics for weapon delivery.

The United States has 56 FB-IIIA bombers that are not counted as strategic bombers by the precedent of arms-control counting rules. These bombers are planned to be transferred to the Tactical Air Forces in the early 1990s.

TABLE C-2. (Continued)

	1994	1995	1996	1997	1998	1999	2000
B-52G							
Penetrate a/	0	0	0	0	0	0	0
Standoff-Penetrate c/	0	0	0	0	0	0	0
Standoff d/	0	0	0	0	0	0	0
B-52H							
Penetrate	0	0	0	0	0	0	0
Standoff-Penetrate	0	0	0	0	0	0	0
Standoff	90	90	90	90	90	90	90
B-1B							
Penetrate	15	0	0	0	0	0	0
Standoff-Penetrate	75	90	90	90	90	90	90
ATB	89	120	120	120	120	120	120
ALCM/ACM e/	2,880	2,880	2,880	2,880	2,880	2,880	2,880
SRAM	923	652	293	0	0	0	0
SRAM II	202	473	832	1,193	1,470	1,470	1,470

a. "Penetrate" refers to the tactic of flying over the target area to deliver the weapon.

b. The B-52G penetrators are shown retiring from their strategic nuclear force role. They are planned for a transition to purely conventional bombers.

c. "Standoff-penetrate" means that the aircraft carries a mixed load of standoff weapons (ALCMs) and short-range weapons, and would remain clear of most defenses while launching the ALCMs and before penetration.

d. "Standoff" aircraft carry ALCMs only and do not fly over the target area.

e. These PAA numbers were derived from ALCM inventory numbers provided in Department of the Air Force Congressional Data Sheets and estimates of ACM deliveries. ACMs will account for somewhat less than half the total inventory.

TABLE C-3. SEA-BASED STRATEGIC FORCE STRUCTURE UNDER THE ADMINISTRATION'S MODERNIZATION PROGRAM (By fiscal year)

	1987	1988	1989	1990	1991	1992	1993
Poseidon C-3							
On line	13	14	15	16	16	16	16
Overhaul	3	2	1	0	0	0	0
Poseidon C-4							
On line	10	12	12	12	12	12	11
Overhaul	2	0	0	0	0	0	0
Trident C-4 a/							
On line	8	8	8	8	7	6	5
Overhaul	0	0	0	0	1	2	2
Trident D-5 Backfit b/							
On line	---	---	---	---	---	---	1
Overhaul	---	---	---	---	---	---	0
Trident D-5							
On line	---	---	1	2	4	5	6
Overhaul	---	---	---	---	---	---	0
SLCM (Nuclear-armed) c/	183	287	423	622	758	758	758

SOURCE: Congressional Budget Office projections.

NOTES: The status of submarines is shown as of the last day of each fiscal year. Submarines not in overhaul or in post-overhaul shakedown periods are considered to be on line. Submarines are considered to be in overhaul if they are actually in overhaul or in post-overhaul shakedown periods.

a. Delivery dates for Tridents 1 through 15 are from Department of the Navy Congressional Data Sheets for the President's fiscal year 1988/1989 budget. Data for Tridents 16 through 20 are extrapolated from these data. Based on data supplied by Navy officials, CBO assumes the initial Trident overhauls will occur nine years after delivery; overhauls last 12 months plus an eight-month shakedown period after delivery and before the submarine goes on patrol. See also testimony of Rear Admiral James D. Murray, Jr., USN, before the Subcommittee on Defense, House Committee on Appropriations, *DoD Appropriations for 1980* (March 15, 1979), pt. 3, p. 418.

TABLE C-3. (Continued)

	1994	1995	1996	1997	1998	1999	2000
Poseidon C-3							
On line	14	11	8	5	3	0	0
Overhaul	0	0	0	0	0	0	0
Poseidon C-4							
On line	9	7	5	3	1	0	0
Overhaul	0	0	0	0	0	0	0
Trident C-4 a/							
On line	4	2	1	0	0	0	0
Overhaul	2	2	2	1	0	0	0
Trident D-5 Backfit b/							
On line	2	4	5	7	8	8	8
Overhaul	0	0	0	0	0	0	0
Trident D-5							
On line	7	8	9	10	11	12	12
Overhaul	0	0	0	0	0	0	0
SLCM (Nuclear-armed) c/	758	758	758	758	758	758	758

b. Trident D-5 backfit submarines are shown here to distinguish these conversions from the delivery of Tridents equipped with D-5 missiles. The backfit generally will be done with overhaul of the Trident C-4 submarines.

c. The total inventory objective for the nuclear-armed version of the Tomahawk land-attack missile (TLAM-N) has been widely reported, as has its initial deployment date. See, for example, the *Congressional Record*, May 31, 1984, H5051-5052; and *Armed Forces Journal International* (April 1987), p. 24. The *Congressional Record* also stated that the fiscal year 1985 procurement of TLAM-N was 75, or about 42 percent of the total Tomahawk procurement for that year. This schedule assumes that TLAM-N consistently accounts for 42 percent of the annual Tomahawk procurement because of its importance to the Administration's strategic program.

TABLE C-4. CHARACTERISTICS OF U.S. BALLISTIC MISSILE FORCES

System	Number of Reentry Vehicles	Yield per RV (Kilotons)	CEP (Nautical miles)	Throw-weight (In thousands of pounds)	System Avail-ability (Day-to-day)
Minuteman II	1	1,200	0.34	1.6	0.95 a/
Minuteman III					
Mk12	3	170	0.10	2.4	0.95
Mk12A	3	335	0.10	2.4	0.95
MX (Peacekeeper)	10	300	0.05	7.9 b/	.95
SICBM	1	475 c/	0.07	1.3 d/	0.90 e/
Poseidon (C-3)	10	40	0.25	3.3	0.66 f/
Trident I (C-4)	8	100	0.15	3.0+	0.66
Trident II					
Mk4	12 g/	100	0.08	5.3 h/	0.66
Mk5	8	475	0.08	5.3	0.66
SLCM (TLAM/N)	1	170	0.05	---	n.a.

SOURCE: Congressional Budget Office from data in John M. Collins, *U.S.-Soviet Military Balance*, 1977-1986 (Congressional Research Service, Report No. 87-745-S, 1987); T. Cochran, W. Arkin, M. Hoenig, *Nuclear Weapons Databook: Volume I--U.S. Nuclear Forces and Capabilities* (Cambridge, Mass.: Ballinger Publishing Co., 1984, for the National Resources Defense Council, Inc.); W. Arkin, T. Cochran, M. Hoenig, "Resource Paper on the U.S. Nuclear Arsenal," *Bulletin of the Atomic Scientists*, vol. 40, no.7 (August/September 1984), *The Military Balance 1986-1987* (International Institute for Strategic Studies, 1986).

NOTE: RV = reentry vehicle; CEP = Circular Error Probable; n.a. = not available.

a. Minuteman alert rates are said to be "well above 90 percent" and "virtually 100 percent" by DoD officials. See respectively, Office of the Joint Chiefs of Staff, Military Posture for 1983, p. 71, and testimony of Lt. Gen. Kelly Burke, USAF, before the House Committee on Armed Services, February 25, 1982.

b. From Department of Defense, "White Paper on the MX Missile System" (July 19, 1982), stating that the throwweight of MX is comparable to that of the Soviet SS-19, and about half that of the Soviet SS-18.

c. Arkin and others (1984) state that the W-87 warhead is designed so that its "baseline" yield of 300 kt can be upgraded to 475 kt by changing fissile materials. CBO assumes that the higher yield will be used for the SICBM.

d. Based on an article by Brigadier General Charles May in *Program Manager* (September-October 1986), stating that the 30,000 pound version had 1,000 pounds of throwweight. Current plan is for a 37,000 pound missile.

e. Since SICBM will be on a mobile transporter, CBO assumes its availability will be lower than that of the silo-based forces.

f. Based on recent estimates from Navy officials.

g. Michael Gordon, "U.S. Plans to Test Submarine Missile With 12 Warheads," *New York Times* (October 7, 1987), p. 1.

h. Estimate based on testimony of Rear Admiral William A. Williams, USN, before the Subcommittee on Strategic and Theater Nuclear Forces, Senate Committee on Armed Services, October 30, 1981, stating that the Trident II missile has about 75 percent more payload capability than the Trident I missile.

TABLE C-5. CHARACTERISTICS OF U.S. STRATEGIC BOMBER FORCES

System	Weapons Carriage (Maximum) Bombs	SRAM	ALCM	Weapon Yield (Kilotons)	CEP (Nautical miles)
B-52G					
Penetrate	4	8	0	---	---
Standoff-Penetrate	4	8	12	---	---
Standoff	0	0	12	---	---
B-52H					
Penetrate	4	8	0	---	---
Standoff-Penetrate	4	8	12	---	---
Standoff	0	0	20	---	---
B-1B					
Penetrate a/	8	16	0	---	---
Standoff-Penetrate	8	16	14	---	---
Standoff	0	0	22	---	---
ATB b/	5	10	0	---	---
Gravity Bomb	---	---	---	1,000	0.07-0.10
ALCM/ACM	---	---	---	200	0.05 c/
SRAM	---	---	---	200	0.20
SRAM II	---	---	---	200	0.05 d/

SOURCE: Congressional Budget Office estimates. Unless otherwise indicated, weapons carriage parameters are based on Undersecretary of Defense Richard A. DeLauer, letter of November 17, 1981, to Senator Ted Stevens, *Congressional Record*, December 1, 1981, S14171-14172. Other parameters are from testimony of Paul Nitze before the Senate Committee on Foreign Relations, July 12, 1979. See also John M. Collins, *U.S.-Soviet Military Balance*, 1977-1986 (Congressional Research Service, Report No. 87-745-S, 1986), pp. 24-25.

NOTE: The table indicates maximum weapons carriage for a mix of weapons. Operational weapons carriage is often less than maximum capability for a variety of reasons. One reason may be constraints imposed by the available inventory of weapons, especially in the case of the SRAM. Other reasons may relate to the characteristics of the planned mission. For example, the B-1B can hold either weapons or fuel in some internal weapons bays, depending on mission requirements.

a. Estimates assume no weapons carried externally in a penetrator mission. Up to 14 additional bombs/SRAMs could be carried externally.

b. The Advanced Technology Bomber (B-2) is reportedly capable of carrying less than half the payload of the B-1B. See Congressman Bill Chappell, Jr., statement in *Congressional Record*, November 18, 1981, H8488.

c. This is a composite estimate based on Nitze, op. cit.; information in Richard K. Betts, ed., *Cruise Missiles: Technology, Strategy, Politics* (Washington, D.C.: Brookings Institution, 1981); and Congressman Les Aspin, "Judge Not by Numbers Alone," *Bulletin of the Atomic Scientists* (June 1980), pp. 28-33.

d. The ring-laser gyro guidance system for the SRAM II will reportedly make it more accurate than the SRAM. See *International Defense Review* (August 1987), p. 1018.

APPENDIX D

SOVIET STRATEGIC FORCES

TABLE D-1. ILLUSTRATIVE SOVIET BALLISTIC MISSILE FORCES AND CHARACTERISTICS

System	Number Deployed 1987	1990	1996	Number of Reentry Vehicles	Yield per RV (Kilotons)
SS-11	440	250	0	1	950
SS-13	60	0	0	1	600
SS-17	150	0	0	4	750
SS-18	308	258	0	10	500
Follow-on	0	50	308	14	500
SS-19	360	360	150	6	550
SS-X-24/silo	0	150	360	10	(100)
SS-X-24/mobile	0	50	100	10	(100)
SS-X-25 c/	100+	252	252	1	(550-1,200)
SS-X-25MOD2	0	0	189	3	(335-550)
SS-N-6 (YI)	272	208	128	1	1,000
SS-N-8 (DI, DII)	292	292	256	1	800
SS-N-18 (DIII)	224	160	0	3	500
SS-N-20 (Typhoon)	80	120	200	6-9	(100)
SS-N-23 (Delta III, IV, V)	64	144	368	10	(250)

SOURCE: Congressional Budget Office estimates. Force structure estimates are based primarily on Department of Defense, *Soviet Military Power 1987*, and testimony of Robert M. Gates and Lawrence K. Gershwin (representatives of the Central Intelligence Agency) before a joint session of the Subcommittee on Strategic and Theater Nuclear Forces, Senate Committee on Armed Services, and the Defense Subcommittee, Senate Committee on Appropriations, "Soviet Strategic Force Developments," June 26, 1985. System characteristics based on John M. Collins, *U.S.-Soviet Military Balance*, 1977-1986 (Congressional Research Service, Report No. 87-745-S, 1987); Barton Wright, *World Weapon Database*, vol. I, Soviet Missiles (Brookline, Mass.: Institute for Defense and Disarmament Studies, 1986); *The Military Balance 1986-1987* (International Institute for Strategic Studies, 1986); Michael R. Gordon, "CIA Downgrades Estimate of Soviet SS-19," *National Journal*, 29 (July 20, 1985), p. 1692; "Soviets' Nuclear Arsenal Continues to Proliferate," *Aviation Week and Space Technology* (June 16, 1980).

NOTE: System characteristic estimates for the new Soviet missiles are highly speculative, as indicated by parentheses. Trends in estimates for accuracies of Soviet ICBMs attempt to account for expected Soviet efforts to incrementally improve accuracy through modifications of missiles. n.a. = not available.

TABLE D-1. (Continued)

System	Circular Error Probable (Nautical miles) a/ 1987	1990	1996	Throw-weight (In thousands of pounds)	System Avail-ability b/
SS-11	0.76	0.76	0.76	2.2	0.85
SS-13	0.82	0.82	0.82	1.3	0.85
SS-17	0.20	0.20	0.20	6.0	0.95
SS-18	0.13	0.13	0.13	16.7	0.95
Follow-on	---	0.10	0.10	16.7	0.95
SS-19	0.20	0.20	0.20	7.5	0.95
SS-X-24/silo	---	0.20	0.15	8.0	0.95
SS-X-24/mobile	---	0.22	0.17	8.0	0.85
SS-X-25	0.20	0.20	0.20	3.0	0.85
SS-X-25MOD2	---	---	0.15	3.0	0.85
SS-N-6 (YI)	---	0.7	--	1.6	n.a.
SS-N-8 (DI, DII)	---	0.8	---	1.8	n.a.
SS-N-18 (DIII)	---	0.5	---	2.5	n.a.
SS-N-20 (Typhoon)	---	(0.5)	---	(3-5)	n.a.
SS-N-23 (Delta III, IV, V)	---	(0.4)	---	(3-5)	n.a.

a. Single estimates are for all three years and reflect lack of data regarding trends in SLBM accuracy; official sources do not predict that the Soviets will acquire hard-target capable SLBMs in the time frame of this study.

b. Older liquid-fueled ICBM systems assumed analogous to Titan II; newer systems assumed similar to U.S. ICBMs. It is difficult to provide availability figures for Soviet SLBMs. Availability of older, shorter-range systems is much less than that for the United States. However, the newer long-range systems that the Soviets could launch from or near their home ports presumably have fairly high availability rates.

c. *Soviet Military Power, 1987*, p. 120, states that the SS-25 is five times more accurate than the SS-13--the USSR's first solid-propellant ICBM--and it has twice the throwweight. This would give it substantially greater throwweight than the single-warhead Minuteman II, which has a 1,200 kt warhead.

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TABLE 2. UNITED STATES AND SOVIET STRATEGIC FORCES IN 1987

System	Launchers	Warheads per Launcher	Total Warheads
	United States		
ICBMs			
Minuteman II	450	1	450
Minuteman III	523	3	1,569
MX	27	10	270
Subtotal	1,000		2,289
SLBMs			
Poseidon (C-3)	256	10	2,560
Poseidon (C-4)	192	8	1,536
Trident (C-4)	192	8	1,536
Subtotal	640		5,632
Bombers			
B-52G	69	8	552
B-52G (With cruise missiles)	98	16	1,568
B-52H	48	10	480
B-52H (With cruise missiles)	48	16	768
B-1B	64	16	1,024
Subtotal	327		4,392 a/
TOTAL	1,967		12,313
	Soviet Union		
ICBMs			
SS-11	440	1	440
SS-13	60	1	60
SS-17	150	4	600
SS-18	308	10	3,080
SS-19	360	6	2,160
SS-X-25	100	1	100
Subtotal	1,418		6,440
SLBMs			
SS-N-6	272	1	272
SS-N-8	292	1	292
SS-N-18	224	1-7	1,568
SS-N-20	80	6-9	720
SS-N-23	64	10	640
Subtotal	932		3,492
Bombers			
Bear	100	4	400
Bear H	50	8	400
Bison	15	4	60
Subtotal	165		860
TOTAL	2,515		10,792

SOURCE: Congressional Budget Office estimates.
NOTE: Reflects total inventories. Does not include U.S. FB-111 and Soviet Backfire bombers.
a. Notional weapons carriage parameters, based on estimates of total inventories of bomber weapons. May slightly overstate inventories.